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**Information technology –
Home Electronic System (HES) Architecture –
Part 1:
Introduction**



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TECHNICAL REPORT – TYPE 2

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Information technology – Home Electronic System (HES) Architecture –

Part 1: Introduction

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INFORMATION TECHNOLOGY – HOME ELECTRONIC SYSTEM (HES) ARCHITECTURE

Part 1: Introduction

FOREWORD

- 1) ISO (International Organization for Standardization) and IEC (International Electrotechnical Commission) form the specialized system for worldwide standardization. National bodies that are members of ISO or IEC participate in the development of International Standards through technical committees established by the respective organization to deal with particular fields of technical activity. ISO and IEC technical committees collaborate in fields of mutual interest. Other international organizations, governmental and non-governmental, in liaison with ISO and IEC, also take part in the work.
- 2) In the field of information technology, ISO and IEC have established a joint technical committee, ISO/IEC JTC 1. Draft International Standards adopted by the joint technical committee are circulated to national bodies for voting. Publication as an International Standard requires approval by at least 75 % of the national bodies casting a vote.
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The main task of IEC and ISO technical committees is to prepare International Standards. In exceptional circumstances, a technical committee may propose the publication of a technical report of one of the following types:

- type 1, when the required support cannot be obtained for the publication of an International Standard, despite repeated efforts;
- type 2, when the subject is still under technical development or where, for any other reason, there is the future but not immediate possibility of an agreement on an International Standard;
- type 3, when the technical committee has collected data of a different kind from that which is normally published as an International Standard, for example 'state of the art'.

Technical reports of types 1 and 2 are subject to review within three years of publication to decide whether they can be transformed into International Standards. Technical reports of type 3 do not necessarily have to be reviewed until the data they provide are considered to be no longer valid or useful.

ISO/IEC 14543-1, which is a technical report of type 2, was prepared by subcommittee 25: Interconnection of information technology equipment, of ISO/IEC joint technical committee 1: Information technology.

This publication has been drafted in accordance with ISO/IEC directives, Part 3.

This document is issued in the type 2 technical report series of publications (according to 15.22 of the Procedures for the technical work of ISO/IEC JTC 1 (1998)) as a prospective standard for provisional application in the field of Home Electronic Systems (HES), because there is an urgent requirement for guidance on how standards in this field should be used to meet an identified need.

This document is not to be regarded as an International Standard. It is proposed for provisional application so that information and experience of its use in practice may be gathered. Comments on the content of this document should be sent to IEC Central Office.

A review of this type 2 technical report will be carried out not later than three years after its publication with the option of extension for a further three years or conversion either to an International Standard or withdrawal.

ISO/IEC TR 14543 Information technology – Home Electronic System (HES) architecture consists of three parts:

Part 1: Introduction

Part 2: Device modularity

Part 3: Communication layers

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INTRODUCTION

Various electrically controlled devices are used in homes and similar environments for many different applications. Examples of such applications are: lighting, heating, food preparation, washing, energy management, water control, fire alarms, blinds control, different forms of security control and entertainment (audio and video). An overview of such applications is given in the "Catalogue of Applications of the HES" (see Informative reference).

When several such devices are able to interwork via a common internal network (in this document called a home network), the resulting total system is called a home control system. When a home control system follows all the specifications in the ISO/IEC *HES Standards*, it is called a Home Electronic System (HES).

Three different classes of HES are defined. Class 1 has transport capabilities for telecontrol applications only. Class 2 includes Class 1, but also supports switched medium bandwidth data channels. Class 3 includes Classes 1 and 2 and in addition supports high bandwidth switched data channels.

A home network may be based on one or more different media (for example power line, balanced cables, infrared or radio) and may also be connected to outside networks (for example telephone, cable television, power and alarm networks).

An implementation of the Home Electronic System will typically be assembled by a consumer, one application at a time, starting from single applications like lighting control, security control or audio and video control, to develop eventually into an integrated multi-application system. The cost of adding an application depends on whether rewiring of the house is needed or whether existing cables and prefitted ducts can be used. Hence the HES standards and supplementary technical reports will also give guidance to architects and builders as well as to users on how to share such resources.

Lifetime and innovation cycles vary between one device and another and between devices and networks. To make it possible to add and to change existing devices as well as to enlarge and to upgrade the home network keeping the existing devices, several stable interfaces, the Universal Interface (UI) and the Process Interfaces (PIs) are defined between the home network and the devices. The PIs are meant for simple devices not requiring the full implementation of the HES application protocol. By using these interfaces a manufacturer can design a device both to meet his specific marketing objectives and to give the option to integrate that special device into a multi-application Home Electronic System. This added value allows the user to take advantage of synergy between different applications.

To allow manufacturers to implement cheaper devices/network combinations, an HES conformance type B is defined. In this case a device connects directly to the medium without showing the UI or a PI. These devices will, however, be medium dependent and do not have the advantages of devices with full HES conformance (type A conformance where the devices include the Universal Interface).

INFORMATION TECHNOLOGY – HOME ELECTRONIC SYSTEM (HES) ARCHITECTURE

Part 1: Introduction

1 Scope

This part of ISO/IEC 14543 gives an introductory description of the Home Electronic System.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of ISO/IEC 14543. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this part of ISO/IEC 14543 are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO/IEC 2382-26:1993, *Information technology – Vocabulary – Part 26: Open Systems Interconnection*

ISO/IEC TR 15044:2000, *Information technology – Terminology for the Home Electronic System (HES)*

3 Definitions

For the purposes of this Technical Report the following definitions as well as the terms defined in ISO/IEC TR 15044 apply:

3.1

application layer

the layer that provides means for the application processes to access the OSI environment

[ISO/IEC 2382-26, definition 26.02.03]

3.2

layer (in OSI)

in the open systems interconnection reference model, one of seven conceptually complete, hierarchically arranged groups of services, functions, and protocols, that extend across all open systems

[ISO/IEC 2382-26, definition 26.02.01]

3.3

network layer

the layer that provides for the entities in the transport layer the means for transferring blocks of data, by routing and switching through the network between the open systems in which those entities reside

[ISO/IEC 2382-26, definition 26.02.07]

3.4

open systems interconnection reference model (OSI reference model)

a model that describes the general principles of open systems interconnection and the network architecture resulting from those principles

[ISO/IEC 2382-26, definition 26.01.05]

3.5

protocol (in OSI)

a set of semantic and syntactic rules that determine the behavior of entities in the same layer in performing communication functions

[ISO/IEC 2382-26, definition 26.03.03]

3.6

service (in OSI)

a capability of a given layer and the layers below it that is provided to the entities of the next higher layer

[ISO/IEC 2382-26, definition 26.03.01]

NOTE The service of a given layer is provided at the boundary between this layer and the next higher layer.

4 Standardization strategy for the Home Electronic System

HES standards and technical reports specify rules to guarantee, in a multivendor – multi-application context, free implementation and configuration of the system and interoperations between the devices in the system.

The basic principle used in the standards is to separate the devices and the network and to have stable interfaces, the Universal Interference (UI) and the Process Interferences (PI), between them. The standards and technical reports do not cover the medium and the associated access units, but specify the services provided through these interfaces and for their local implementations.

In addition, a reduced level of conformance to the standard, type B conformance, is defined without the UI or PIs. Type A conformance is the primary strategy, including the UI or a PI. Type B conformance does not include either the UI or a PI.

With type B conformance, devices are connected directly to the network medium (although type B conformant devices may be implemented in more than one physical unit). Type B conformant devices can be connected only to a specific (proprietary) home network medium. However, these devices will still implement the HES Network Service and the Application Service and Protocol, allowing routers (gateways that do not interpret protocols above the network layer) to be implemented between different implementations of the Home Electronic System.

This strategy is described in the following subclauses.

4.1 Free choice of implementation

The main strategy for HES standardization is to have stable interfaces (the UI and the PIs) between devices and networks (see figures 1 and 2), and thus to make the devices network independent (type A conformance). However, the standard allows devices to be connected directly to the medium (see figure 4) although this makes the devices network dependent (type B conformance). To be type B conformant a device must be in conformance with the HES Network Service and the HES Application Service and Application Protocol.

The UI is universal in the sense that it allows the interconnection of any device implementing the UI to any home network also implementing UIs (within an HES).

The UI is not universal in the sense that it allows for non HES devices to be connected to an HES, or HES devices to a non HES network.

A manufacturer of a type B conformant device may offer an adapter allowing interworking between his device and type A conformant devices via a UI and an HES network (see figure 6). If this combination of a type B conformant device and an adapter is in conformance with the necessary HES standards, this combination can be claimed to be in type A conformance with the Home Electronic System.

If a manufacturer claims conformance with the HES, the type of conformance (type A or B) must be clearly stated in the same place.

4.2 Medium- and device-independent interface

The main strategy for the HES standardization is to split the system into two parts:

- the home network;
- the devices connected to it.

With a stable interface between the two parts, home networks which are **medium dependent**, and devices which are **application dependent** can be developed separately (see figure 1).

In addition to specifying the stable interfaces, HES standards specify the rules for information exchange between devices (via the interfaces and the home network). These rules are specified in the HES Application Protocol.

Figure 1 represents the home network as a bus; this is, however, just an example of topology. The HES places no restriction on home network topology.

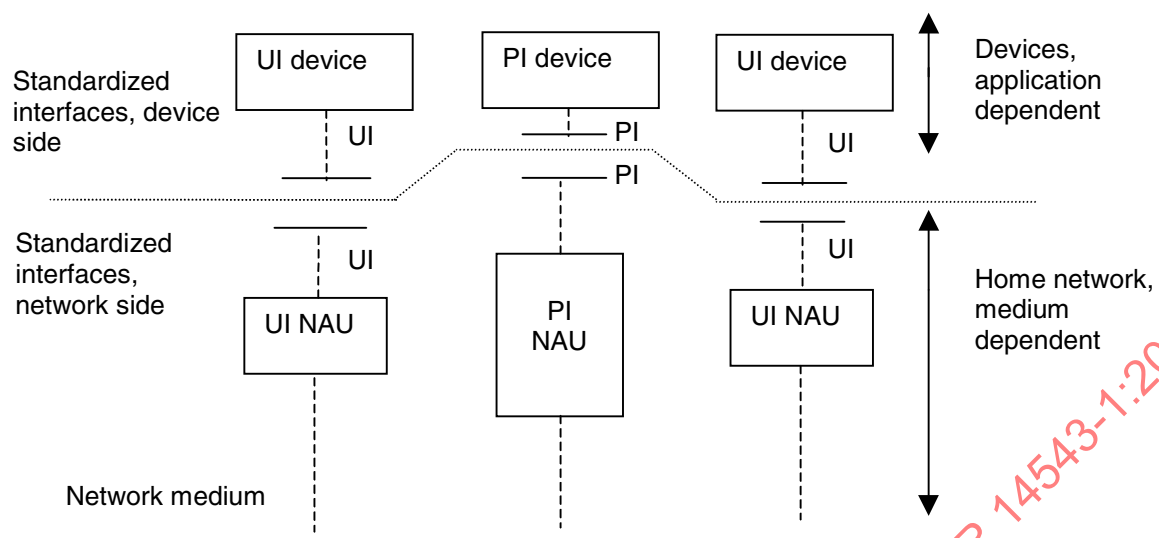


Figure 1 – Application- and medium-dependent parts of the HES

The standardized interface is either the Universal Interface (UI) or one of the Process Interfaces (PIs). Note that the UI and the PIs need different sets of functions in the NAU. Figure 2 shows the concepts of the UI and the PIs.

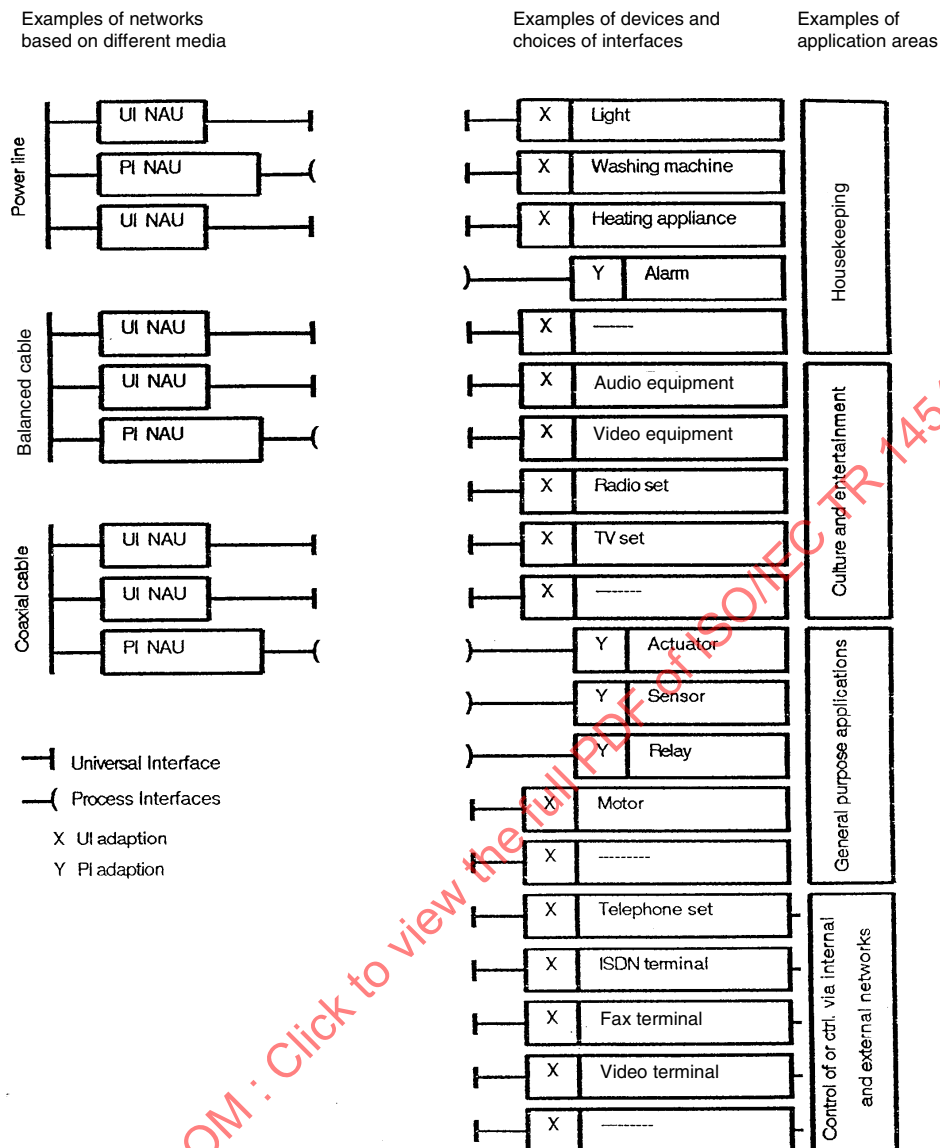
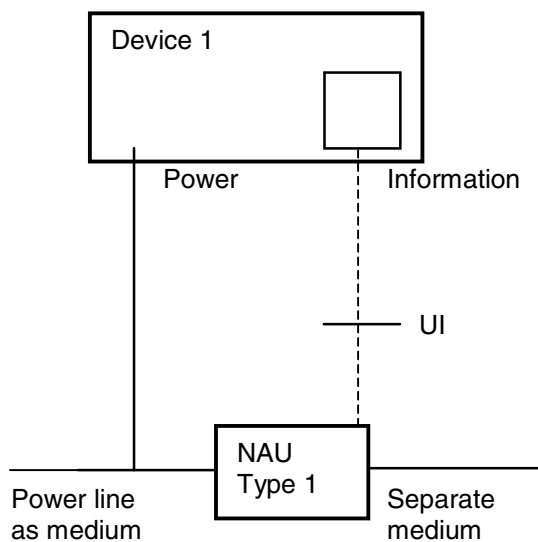


Figure 2 – Examples of Universal Interfaces and Process Interfaces as stable interfaces between devices and home networks (Class 1)

Figure 3 any network UI may be connected to any device UI, and any network PI to any corresponding device PI.

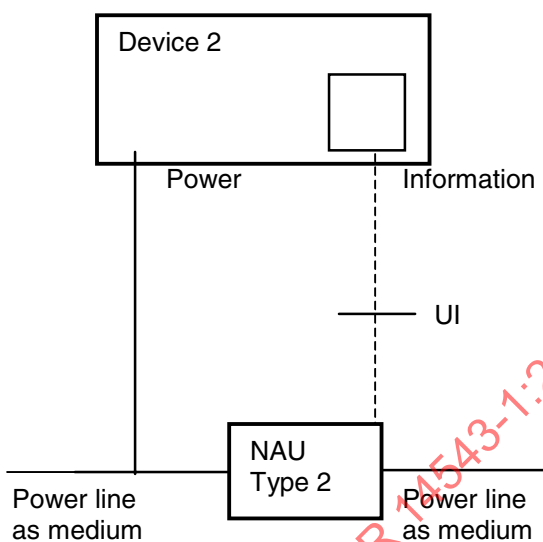
Figure 4 gives only an indication of some possible implementations. The HES does not preclude other combinations of devices and UIs and PIs.

Figure 5 shows how a device using the UI can be integrated into implementations of the HES based on different media.



Device connected to mains cabling as power source and to a separate home network medium.

Figure 3a – Device connected to separate media



Device connected to mains cabling as power source and as home network medium. The NAU is external to the device.

Figure 3b – Device connected to powerline as media

Figure 3 – Example of the use of the same device in different environments

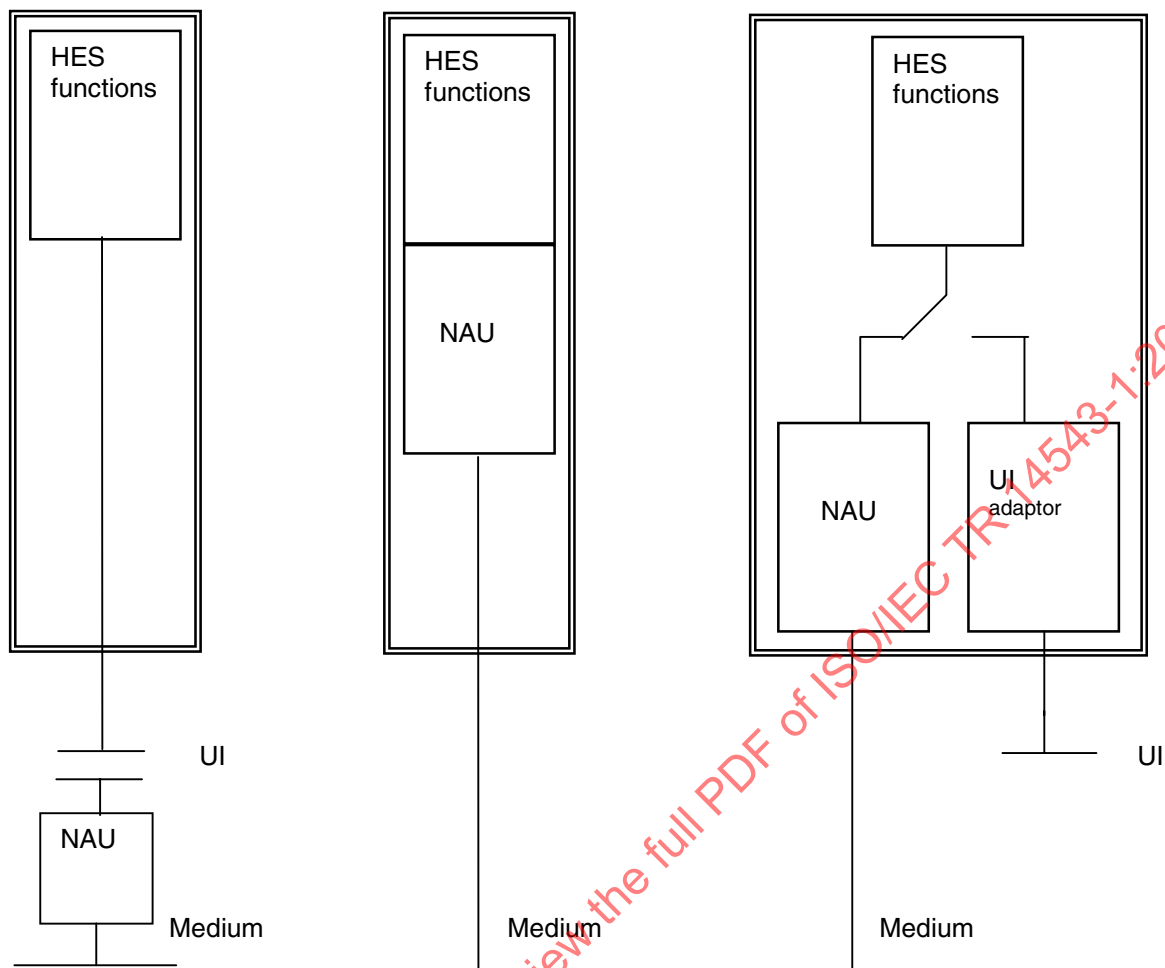


Figure 4a – Type A conformance

Figure 4b – Type B conformance

Figure 4c – Type A conformance

Figure 4 – Device configurations with different types of HES conformance

4.3 Multimedia and multi-vendor home control system

Traditionally, realizations of home control systems have been based on one specific transmission medium, for instance balanced cables or mains power cabling. The devices designed for these systems can be connected only to the medium they are designed for. Furthermore, different proprietary implementations do not normally communicate with each other and might even interfere with each other when installed on the same transmission medium.

The UI and the PIs introduced in the HES allow connection of devices from different sources to home networks implemented in different technologies. This provides portability of devices from one medium and network to another thus allowing a large variety of devices from different sources to be used within one HES. Also devices for a variety of applications can share the same network.

The architecture, using a UI or PI is called “Type A conformance”. A reduced level of conformance to the standard “Type B conformance” is defined with the UI or PIs. Type A conformance is the primary strategy and includes the UI or a PI. Type B conformance does not include either the UI or a PI.

With Type B conformance, devices are connected directly to the network medium (although Type B conformant devices may be implemented in more than one physical unit). Type B conformant devices can be connected only to a specific home network medium. However, these devices will still implement the HES Network Services and Application Services and Protocol (Command Language) allowing routers to be implemented between different home networks. In this way proprietary home networks may be interconnected with each other, and with home networks implementing UIs or PIs in an integrated Home Electronic System.

Figure 6 illustrates the differences between Type A and Type B conformance. Note that Type B conformant devices are network dependant. If a manufacturer claims conformance with ISO/IEC 10192¹⁾, the type of conformance (Type A or Type B) must be clearly stated.

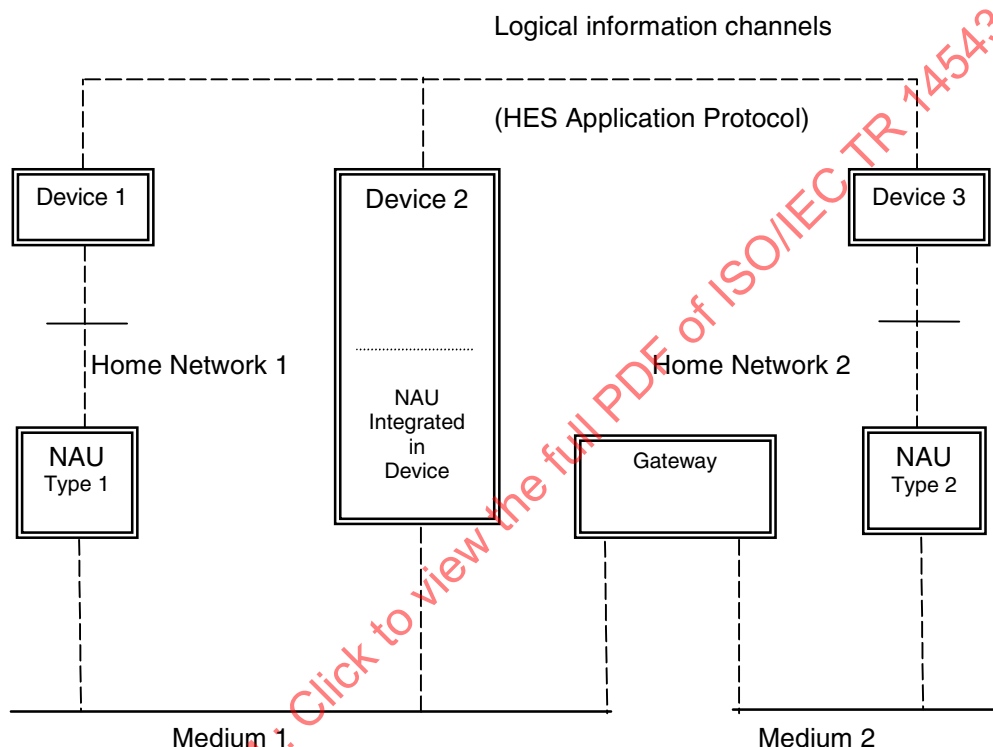


Figure 5 – Multimedia Home Electronic System

In figure 5 two different media are connected by a low level gateway. For type A conformant devices it makes no difference to which medium they are connected. Type B conformant devices can only be connected to a compatible medium. All devices can communicate with each other.

Other internal or external networks such as ISDN may be interconnected with implementations of the HES via appropriate higher level gateways.

Full interworking can be achieved only when the application processes in the devices share a common application protocol. The HES contains such a standardized common application protocol flexible enough to support.

- single vendor products,
- multi-vendor products for single applications,
- multi-vendor, multi-application products.

¹⁾ ISO/IEC 10192: Information technology – Home Electronic Systems (HES) interfaces (to be published).

A manufacturer of a Type B conformant device may offer an adapter allowing interworking between this device and Type A conformant devices via a UI and an HES network, as shown in figure 6.

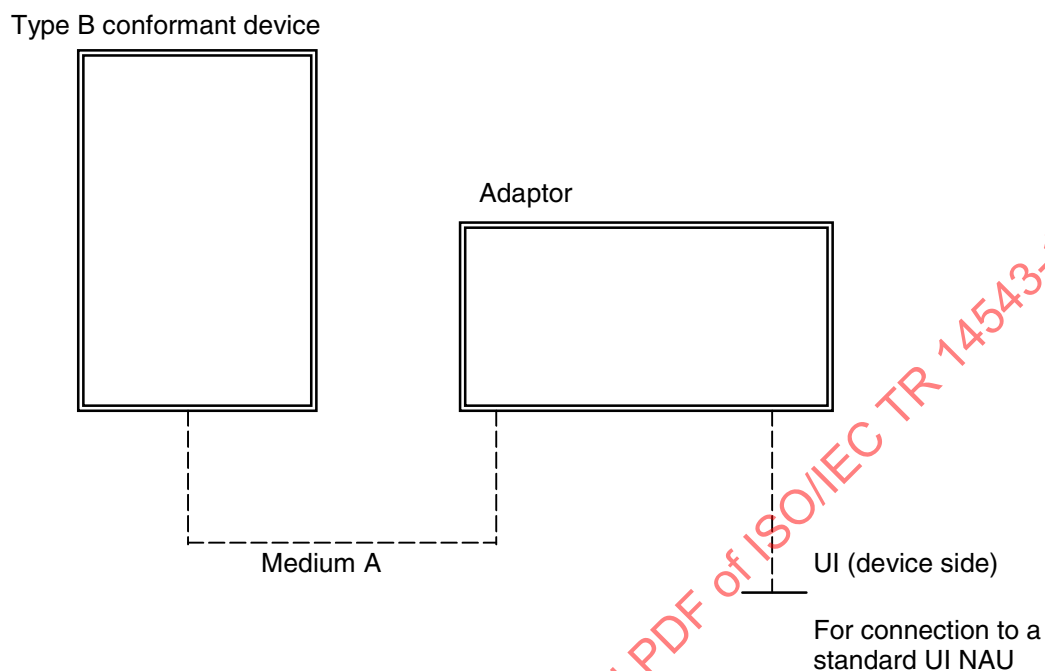


Figure 6 – Type A conformant combination of a type B conformant device and adaptor